BIOVENTING SYSTEMS/REILLY TAR SUPERFUND SITE SUPERFUND INNOVATIVE TECHNOLOGY EVALUATION PREDEMONSTRATION PLAN

SOIL SAMPLING AND ANALYSIS CHARACTERIZATION

Ground Water & Solid Waste Division

Ground Water & Solid Waste Division

Site Response Section

Site Name

Category

Subcategory

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SAIC Project No. 01-0835-07-0228-XXX

August 1992

PREDEMONSTRATION BIOVENTING PROJECT REILLY TAR FACILITY

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1.0 PROJECT DESCRIPTION

The U.S. Environmental Protection Agency (USEPA) established the Superfund Innovative Technology Evaluation (SITE) program to test promising technologies in hazardous waste remediation. Currently, the "Reilly Tar Site" in St. Louis Park, Minnesota, has been selected for the demonstration of EPA's Biosystems Engineering Section's Bioventing Project: "Bioventing for Enhanced Degradation of PAH Contamination at the Reilly Tar Site". The full-scale demonstration will be done under a Cooperative Agreement between USEPA's Biosystems Engineering Section/Battelle Corp.'s Environmental Technology Department (technology developer) and the USEPA's SITE Superfund Technology Demonstration Division. Science Applications International Corporation (SAIC) will serve as a contractor to the USEPA SITE Program and will be responsible for the following activities prior to the demonstration:

- provision of technical assistance to all involved parties by gathering and evaluating technology and site data,
- · pretreatment sampling for characterization,
- site logistical support,
- · permit support, and
- public relations support.

The EPA Biosystems Engineering Section has developed a physical process whereby air is pumped into the ground where an oxygen deficient zone of polynuclear aromatic hydrocarbon (PAH) contamination is known to exist. The system includes the installation of an air injection system as well as a network of soil gas sampling probes. The technology will be field tested to determine whether the system will effectively enhance the in-situ degradation of PAHs over a period of time. Adequate aeration is to be provided to maintain oxygen sufficient conditions for maximizing the degradation of PAH.

The "Reilly Tar Site" was selected by EPA to demonstrate the technology, which is located in St. Louis Park, Minnesota. Between 1917 and 1972, the Reilly Tar and Chemical Corporation operated a coal tar distillation and wood preserving plant known as the Republic Creosote Co., in St. Louis Park. Spills and discharge of contaminated wastewater at the Reilly Tar Site have caused extensive contamination.

Prior to full-scale demonstration of the Bioventing process, all parties have agreed to conduct a predemonstration sampling program to further characterize the soil and contamination at the site. The predemonstration will include a site assessment, mapping of site layout, oversight of soil gas survey by Battelle Corp., and the sampling of three soil borings each to a depth of 10 feet.

This predemonstration plan describes how SAIC will carry out these tasks. Each task is described in more detail in subsequent sections.

2.0 OBJECTIVES

SAIC's main objective of this predemonstration plan is to characterize the upper 10 feet of soil designated as the treatment plot designated by Battelle's soil gas survey. The soil characterization is necessary to confirm the type and level/range of contamination and confirm that no contaminants are present which may interfere with the Bioventing process. Specific objectives of this plan are as follows:

- 1.) Site Assessment to Familiarize SAIC with Site.
- 2.) Map Demonstration Site
- 3.) Observe Soil Gas Survey by Battelle Corp. and Delineation of Treatment Plot Borders
- 4.) Collect Soil Samples at Three Locations within the Treatment Plot to a Depth of Ten Feet Below Land Surface
- 5.) Analyze Collected Soil Samples for Volatile Organic Compounds, Semi-volatile Organic Compounds, Total Petroleum Hydrocarbons,
 Total Organic Carbon, Total Inorganic Carbon, Nitrate/Nitrite,
 Ortho-phosphate, Full Metals Scan, Mercury by CVVA, and Total Cyanide.

These considerations have been incorporated into this predemonstration program to assure SAIC's main objective.

3.0 SITE DESCRIPTION

The "Reilly Tar Site" is located at 3501 Louisiana Avenue, St. Louis Park, Minnesota as shown in Figure 3-1. According to the Petroleum Tank Release Investigation Report ID #LEAK00001546 by ENSR Consulting and Engineering (1990), the Reilly site is approximately 80 acres in size and was formerly a coal tar refinery and wood treating plant operated from 1917 and 1972 by Reilly Industries, Inc. The major feature of the site is building #19, a large warehouse serviced by rail lines both inside and outside. The only feature of the site known to involve chemical or petroleum usage or handling, is the former gasoline underground storage tank, piping, and fuel dispensing pump. The pump was located along the entrance road to the facility. The major operations conducted at the "Reilly Tar Site" were located in the central portion of the site at the refinery and the treating building #25. Numerous above-ground storage tanks were located in the central portion of the site. The types of materials stored in the tanks were creosote oil, various tars, pitch, fuel oils, blended treating oils, and gasoline. The wood preserving solution used by Reilly was a mixture in the range of 60 to 70 percent creosote oil mixed with the petroleum oils (several hundred thousand to over 1 million gallons used annually).

Previous environmental studies of the Reilly Site indicate the greatest areas of contamination exist around the treating building and the refinery (ERT, 1983). Contamination from operations were primarily due to spillage of process materials, drippings from leaky piping, precipitation wash-off from stockpiled treated lumber, and wastewater discharge. The distribution of these sources was a major factor in the resulting distribution of contaminants, as was the drainage pattern at the site and the historical redistribution of soils during demolition and construction projects on-site. Episodes of general flooding at the site, in combination with the routine wastewater discharge, produced an extensive accumulation of

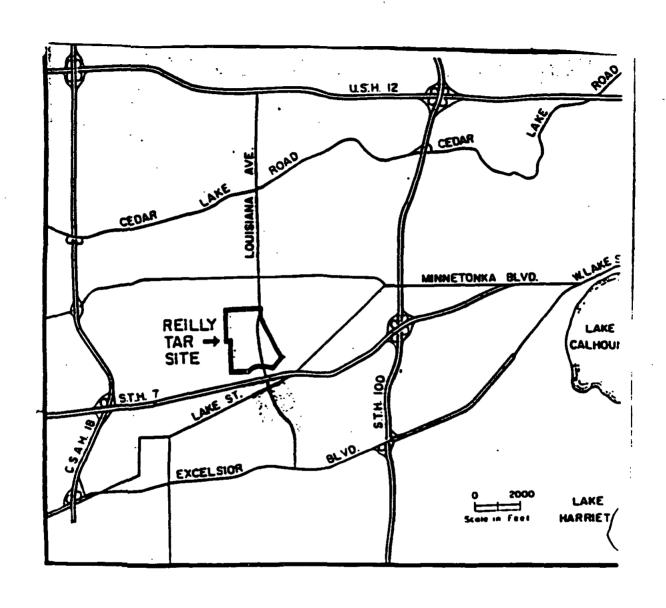


FIGURE 3-1 LOCATION MAP - REILLY SITE, ST. LOUIS PARK

contaminants in the bog area south of the site. In 1972, all above and below grade tanks were removed and any basements, pits, or low areas were to be filled with small masonry and earth materials from the site. The site was then leveled to a rough grade. In addition, the area was further disturbed during the construction of Louisiana Avenue and the associated sewer system.

The location of the USEPA SITE Pre-Demonstration and possible Demonstration will be west of Louisiana Avenue near the former site of the refinery (See Figure 3-2). Some site specific information exists on this area, as well as some general information on sitewide conditions regarding contamination and geohydrology as cited below, also exists.

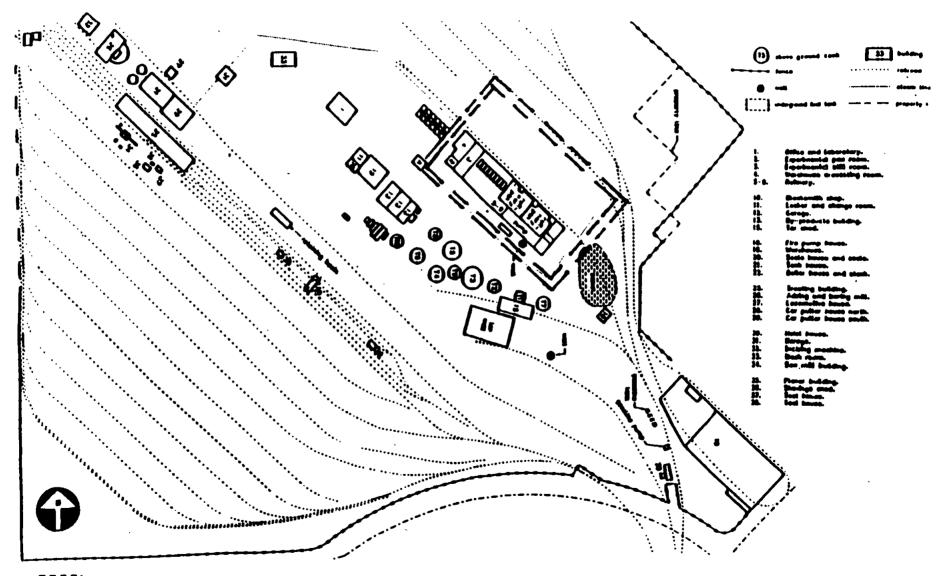
Soil Contamination

The delineation of contamination west of Louisiana Avenue near the SITE Predemonstration area is not adequately defined for SAIC's purposes. Some information on the levels of contamination at the Pre-Demonstration area are evident in the Boring Log for #PB-140 and through the interpretation of investigative results nearby east of Louisiana Avenue. Figure 3-3 indicates the extent of contamination at the site based on the results of the soil borings, soil vapor surveys, test trenches, and analysis of soil samples by ENSR on the eastern side of the "Reilly Tar Site" (the side closest to the SITE Demonstration area), east of Louisiana Avenue. The contaminated areas in Figure 3-3 are presented as core areas (dark stiple pattern) where contamination has been adequately documented by the investigation results, surrounded by fringe areas (light stiple pattern) where the investigation results estimate marginal contamination.

Soil Borings:

Boring #PB-140 displayed evidence of soil contamination through soil analyses, visual staining (black), and by exhibiting a tarry odor. A summary of total PAH concentrations found at Boring #PB-140 are as follows:

- 2-4'bls....3997.00 mg/kg
- 4-6'bls..... 38.10 mg/kg



 $\begin{bmatrix} \mathbf{r}_1 & \mathbf{r}_2 & \mathbf{r}_3 \\ \mathbf{r}_4 & \mathbf{r}_4 & \mathbf{r}_3 \end{bmatrix}$ = Possible demonstration site

FIGURE 3-2 80-ACRE REILLY TAR SITE

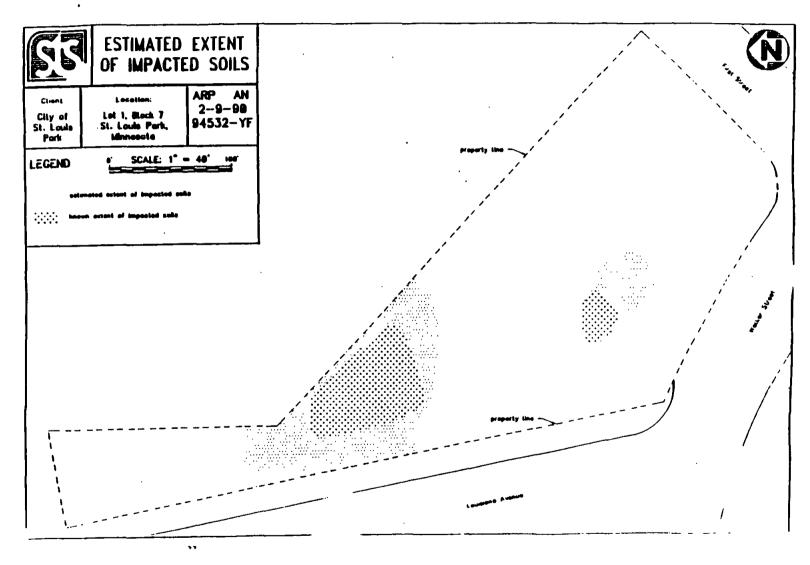


FIGURE 3-3
ESTIMATED EXTENT OF IMPACTED SOILS

• 6-8'bls..... 3.34 mg/kg

In 1988, eighteen (18) soil borings were drilled to depths of 11 to 41 feet (Figure 3-4). Soil contamination is approximately centered around borings B-5, B-A, B-B, B-C, and B-D, in the center of the site, east of Louisiana Avenue. Analytical results for these borings are shown in Table 3-1.

Soil Gas Surveys:

ENSR conducted a soil gas survey of the unsaturated zone using a Photovac 10S50 GC. Two areas of contamination were identified by the ENSR soil gas survey (Figure 3-5). One area is in the vicinity of B-5 and corresponds to contamination identified by the soil boring investigation. A second area of interest is indicated by relatively high soil vapor VOC concentrations at locations SV-25, SV-26, and SV-27 (Table 3-2).

STS Consultants also conducted a soil gas survey of the site using a charcoal trap and portable air pump method. The STS soil gas survey indicated the presence of four VOCs at location A-5 (Figure 3-5). The VOCs detected were benzene (16.1ppm), ethylbenzene (7.5ppm), toluene (8.1ppm), and xylenes (14.08ppm). No other VOCs were detected above the 0.001ppm detection limit.

Test Trenches:

In addition, ENSR installed a series of trenches at the site (Figure 3-6). The soils in the vicinity of soil boring B-5 and in the vicinity of test trench TP-5 contain relatively high levels of organics that are indicative of the coal tar and petroleum materials utilized during the operational history of the site. The soils in the vicinity of soil boring B-5 were characterized by black staining and creosote-like odors (Table 3-1).

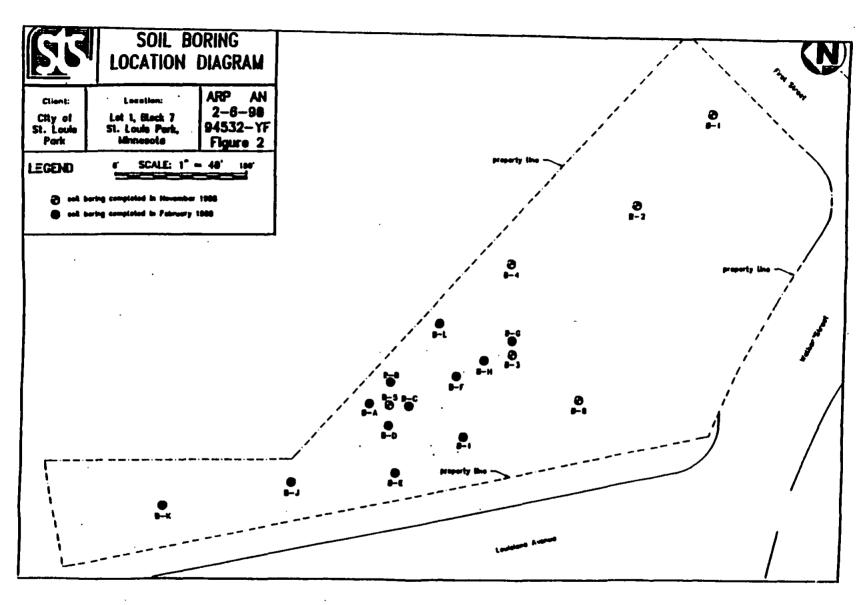


FIGURE 3-4 SOIL BORING LOCATION DIAGRAM

TABLE 3-1 SUMMARY OF SOIL ANALYTICAL DATA

	Sample Identification, Results in Parts Per Million														
Parameter	B-5 7-8.5 ¹⁴	B-L 15-20	B-E 10-11	TP-1 6.0	TP-2 5.5	TP-3 5.0	TP-4 6.0	TP-5	TP-6 3.5						
Phenol	800°+	4.0	<42	0.16	53	0.14	0.39	0.16	0.06						
Benzene	300	<0.6	0.42	(r)											
Benzene extractables	-+-	***		1,200	20,000	420	870	130	460						
Toluene	1,400	1,400 0.91 1							-						
Ethylbenzene	160	3.4	41		•	•••									
Xylene	1,600	13	93			•••			•••						
Total hydrocarbons as gasoline	8,400			Q.4	5,600	<2.5	<1.2	450	47						
Total hydrocarbons as fuel oil	33,000	120	490	90 25,000 33		31	140	2.4	8.9						
Total polynuclear-aromatic hydrocarbons (PAH) th		•••	1610	6,600	44,000	18	220	2.6	97						

a = Sample depth in feet

b = Sample depth 9.5 - 10 feet

c = Not tested

d = Sum total of all PAH compounds identified above detection limits

Source: ENSR "Petroleum Tank Release Investigation Report" February 1990

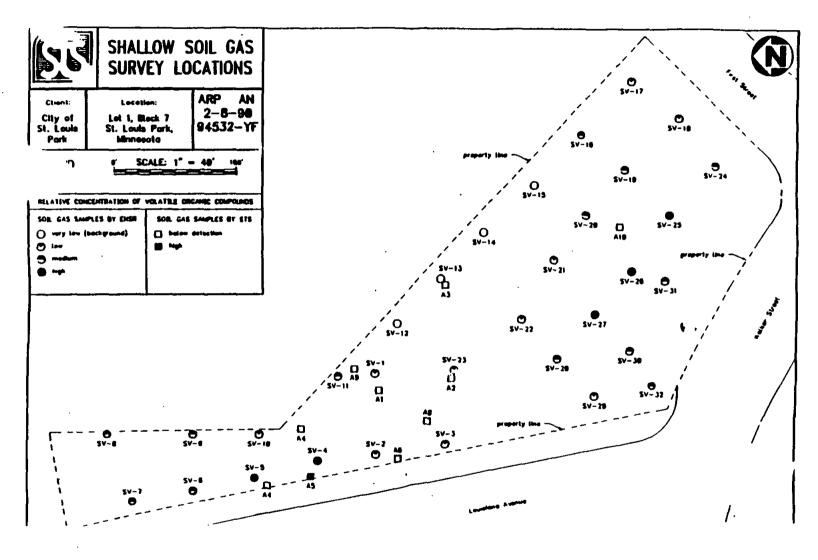


FIGURE 3-5
SHALLOW SOIL GAS SURVEY LOCATIONS

TABLE 3-2 SUMMARY OF ENER'S SOIL VAPOR SURVEY RESULTS

	Total Gas Chromatograph	
Sample No.	Readings (volt-seconds	Relative Ranking
5 V-1	0.4	low
SV-2	0.1	low
sv- 3	0.1	low
SV-4	52.3	high
SV-5	24.6	high
SV-6	1.2	medium
<i>S</i> V-7	9.4	medium
SV-8	5.0	medium
SV-9	1.2	medium
SV-10	0.5	low
SV-11	1.8	medium
SV-12	0.0	background
SV-13	0.0	background
SV-14	0.0	background
SV-15	0.0	background
SV-16	-8	medium
SV-17	~0.5	low
SV-18	0.1	low
SV-19	1.8	medium
SV-20	2.1	medium
SV-21	0.4	low
SV-22	0.7	low
SV-23	0.3	low
SV-24	1.4	medium
SV-25	14.5	high
SV-26	29.6	high
SV-27	22.8	high
SV-28	2.9	medium
SV-29	0.5	low
SV-30	2.7	medium
SV-31	1.5	medium
SV-31 DUP.	0.7	low
SV-32	7.7	medium
SV-32 DUP.	4.2	medium

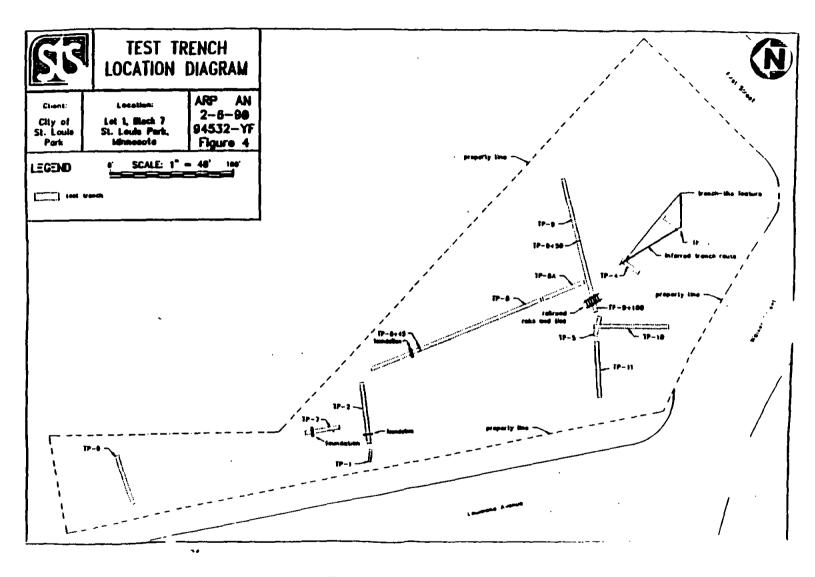


FIGURE 3-6
TEST TRENCH LOCATION DIAGRAM

Geology

Based on previous boring data by investigators, the general subsurface conditions encountered are 4 to 6 feet of artificial fill overlying medium sands and fine gravels. The nearest boring to the proposed SITE Demonstration site is Boring #PB-140. The boring log for Boring #PB-140 is summarized below:

• 0.0-1.75'bls>	Top soil, brown sandy clay with roots and grass
• 1.75-5.0'bls>	Black bituminuous material, well compacted, gravelly sand coated with black material, tar smell, brittle.
• 5.0-8.0'bls>	Coarse moderately sorted brown sand, mostly quartz and rock fragments red in color, 1" layer of black coated sand.
• 8.0-11.5'bls>	Fibrous peat, very uniform layer, gray-black silty clay with gravel, strong tarry smell.
• 11.5-13.0'bls>	Grey medium-fine sand, mostly quartz with some gravel, weathered limestone and crystalline rocks.
• 13.0-16.0'bls>	Very small silty clay, grey on top and brown at bottom interlayered with coarse gravel, till.
• 16.0-65.0'bls>	Outwash, moderately sorted sand and fine gravel, oily coating on grains.

The following is a description of the three major types of unconsolidated sediment (Artificial Fill, Bog Deposits, and Glacio-Lacustrine Deposits) underlying the "Reilly Tar Site:"

Artificial Fill:

Artificial fill underlies most of the surface of the site. Its thickness ranges up to approximately 10 feet. Visual description of the fill indicates that it is typically a silty sand with varying amounts of gravel and occasional demolition debris. North of Bioventing study area, is an exposure of the fill in the sump constructed at well W23, which reveals two black stained fill which resembles layers of pavement. The upper band is approximately 6 to 8 inches thick and is overlain by 4 to 6 inches of topsoil and sod. The second band is approximately 12 inchies thick and lies 18 inches bls. Similarly stained soil was also seen in the spoil pile next to the sump. This area is in the area of the former refinery.

Bog Deposits:

The bog deposits are composed of fibrous peat (probably sphagnum moss), muck (organic silt), and minor amounts of marl (organic silt and clay with a high proportion of precipitated calcium carbonate and/or shells). These deposits represent the natural ageing and filling process of a shallow lake. Much of the sediment in this deposit is of shallow lacustrine (lake) origin, however, the bog deposit nomenclature was chosen to distinguish these highly organic deposits from the relatively inorganic underlying glacio-lacustrine (derived from a lake which formed at or near a glacier) deposits. The muck and marl represent the earliest bottom deposits of the biologically active lake which succeeded the relatively biologically inactive glacio-lacustrine environment. As the lake became shallower and more bog like, increasing deposition of peat took place. These conditions are typical of the shallow lakes which abound in this area on Minnesota.

Bog deposits underlie much of the site in thicknesses of up to 33 feet in the southern most part of the site. These deposits pinch out to the east and west in the plant site. they are also absentin the central part of the plant site. Where the bog deposits occue below the plant site they are generally 5 to 10 feet thick. Below the southern end of the site in what has been referred to as the "swamp," they are more typically on the order of 20 feet thick. These deposits are now exposed at the surface in only three small areas on either side of Highway 7. Some of the bog deposits have been covered with artificial fill.

Glacio-Lacustrine Deposits:

Visual descriptions of the grain-size distribution of the glacio-lacustrine deposits indicate that they are composed of inorganic silty clay. Sieve analysis results have yielded the sediments as clayey sand and fine gravel based on the weight proportion of its constituent grain-size distribution. Although these sediments were deposited in the same lake as the bog deposits, glacial ice was in its latest wasting stage at the time of deposition and the climate was too cold to allow sufficient biologic activity to result in organic deposits.

The boring logs indicate that these deposits underlie the bog deposits wherever they occur. The thickness of the glacio-lacustrine deposits ranges up to 10 feet in the northern end of the site. The bed is typically on the order of 0.5 feet to two feet thick. These deposits are a generally continuous bed of fine-grained (sand, silt, and clay), inorganic sediment underlying the bog deposits.

Hydrogeology:

Groundwater was generally encountered at a depth of 10 to 14 feet below the ground surface. The water table was encountered at 10 feet bls at the closest boring to the proposed SITE Demonstration site, boring PB-140. Seasonal fluctuation in the water table is typically 2 to 4 feet.

4.0 FIELD ACTIVITIES

4.1 SITE ASSESSMENT TO FAMILIARIZE SAIC WITH SITE

SAIC will visit the site and scope out necessary information to support both the SITE Pre-Demonstration and Demonstration. The following information will be collected during the site visit:

- Note Available Utilities, e.g. electric, water, telephone, & sanitary
- Note Health & Safety Concerns, e.g. overhead electric lines, ditches, buried objects, etc.
- Note Physical Structures that may Interfere with Construction or Operation of Developer's Technology
- Note General Layout of Site

4.2 MAP DEMONSTRATION SITE

SAIC will map the demonstration site by using a simple compass and tape method.

The map will only encompass the immediate area of interest and will utilize existing geographic markers (e.g. crossroads, wells, etc..) as points of reference.

4.3 OBSERVE SOIL GAS SURVEY BY BATTELLE CORP. AND DELINEATION OF TREATMENT PLOT BORDERS

SAIC will observe the soil gas survey and subsequent findings, in order to delineate the demonstration treatment plots which will undergo soil characterization by SAIC. The soil gas survey will be performed by Battelle Corp., according to Battelle's Work Plan, found in Appendix A.

4.4 COLLECT SOIL SAMPLES AT THREE LOCATIONS WITHIN THE TREATMENT PLOT TO A DEPTH OF TEN FEET BELOW LAND SURFACE

Three soil boring samples will be collected and analyzed to further characterize the site. The following sections describe drilling procedures for the soil borings.

Soil Boring Locations

Three soil borings will be drilled and samples collected and analyzed. These borings will be positioned using a brunton compass and a tape measure in areas defined by Battelle's soil gas survey as the proposed treatment plots for the SITE Demonstration.

Prior to Drilling

The drilling program mobilization and setup procedures are as follows:

- · Obtain necessary well drilling permits.
- · Obtain access to well location site and stake/mark well location.
- Brief drillers on contents of Predemonstration Plan and Health and Safety Protocols (Chapter 8).
- · Establish decontamination area, as prescribed in drillers Statement of Work (Appendix B).
- · Check drill rig, tools, and support vehicles, to be used for proper decontamination, maintenance, and emergency shut-off switches in case of an accident.
- Establish temporary contaminated soil storage area.
- · Mobilize drill rig and staff to boring location.
- · Plumb rig over staked location, with the body of rig perpendicular to wind direction.
- · Establish safe area upwind from boring location.
- · The SAIC Supervisory Geologist will have all necessary equipment present.
- · Supervisory Geologist will prepare a logbook, as stated later in this section.
- Supervisory Geologist will set-up an on-site decontamination station for personnel and tools to be used during drilling.
- Supervisory Geologist will calibrate the Organic Vapor Analyzer or HNu and Lower Explosive Limit and Oxygen (LEL/O₂) meters as specified by the manufacturer.
- Supervisory Geologist will assure all Health and Safety equipment specified is being wom properly.

Soil Boring Drilling and Sampling Activities

The soil borings will be drilled using the following steps:

- 1. Advance the augers below the land surface to a depth determined by the Supervisory Geologist.
- 2. Once the appropriate depth has been reached, soil samples will be collected using standard 2-foot split-spoon samplers over the 0-10' interval as specified by the SAIC Supervising Geologist.

The general field soil sampling procedures and protocols are presented below:

- All split-spoon samplers must be steam-cleaned, rinsed with Type II water, pesticide-grade methanol then hexane and allowed to air dry prior to use.
- · Decontaminated equipment will be stored in the manner outlined in this section.
- Prior to collecting and logging each sample, prepare a sample log table to be completed in field book. Actual geological logging will be performed after all volatile organic samples have been collected.
- · Carry each spoon pulled from the borehole to the work table to break apart on a clean stainless steel tray (<u>Use Clean Pipe Wrenches</u>). Try not to damage the spoon when coercing it to open.
- For each sample, immediately determine the presence or absence of volatile organic vapors with the HNu or OVA and measure recovery.
- · Empty the filled split-spooned sampler into a stainless steel bowl and deposit.
- Spoon soil into each prelabeled sample jar ASAP (NO MORE THAN TWO MINUTES FROM OPENING SPLIT-SPOON), beginning with the volatile organic container followed by containers to be analyzed for semi-volatile organic compounds, TOC, TPH, total inorganic carbon, etc.. All filled containers will be stored immediately at less than 4 degrees Celsius by using a thermally insulated cooler filled with ice packs.
- Record all observations in to the log book including time, interval the sample was taken, blow counts, geologic description, PID or OVA readings, staining of soil, odors, and any other pertinent observations.
- Field QA samples will be collected according to the schedule presented in Section 6.0 of this plan. Procedures for collecting this sample are specified in Appendix B.
- Decontaminate all equipment and tools between sample collections according to procedures specified in this section.

Special Considerations

- · Limit access of unnecessary personnel to site.
- · Be observant of changing weather conditions as they may compromise worker safety.
- · Make sure no tools or foreign materials fall into the borehole or well.
- Monitor borehole/wells and breathing zones continuously with the Organic Vapor Analyzer/PID and LEL/O₂ meters.
- · Record water, equipment and material usage by driller.
- · No fuel, lubricant, paint or solvent is to come near the borehole or well and materials.

Decontamination Procedures

- Between boreholes, decontaminate drilling equipment (including tools, rods, bits, etc.) at the decontamination area with steam cleaner and an Alconox/water solution.
- Decontamination area established by drilling company shall be designed to contain all wash water and should be kept clean.
- Decontaminated equipment must not be allowed to come in contact with pollutants, so as not to contaminate work area and well.
- · Assure waste washwater is containerized or disposed of in a manner acceptable to site.

Borehole Abandonment

All borings will be abandoned as follows:

• Drilling subcontractors will tremie-grout each boring to the surface with a mixture of bentonite and Type I Portland cement.

Site Cleanup

Each site will be restored to its former condition following the completion of each well. All drill cuttings will be drummed and stored on-site in the storage area designated by SAIC. Drums will be stored temporarily on-site until ultimate disposal. Drum labels will be prepared and affixed to each drum. All additional waste material (i.e., bags, buckets, plastic, etc.) will be collected and transported in appropriate containers to specified locations.

Documentation

Documentation of field activities by the SAIC Supervisory Geologist will be maintained in a bound field notebook of water resistant paper. All entries will be made legibly, in indelible ink, signed, and dated. Information that will be recorded in the field notebook includes:

- · Date, time, and place of activities.
- · Active Personnel On-site (i.e., drillers and visitors).
- · Weather Conditions (i.e., temperature, wind direction, and precipitation)
- · Site Observations (odors, soil appearance, etc.)
- · Rig type and drill method.
- · Field equipment calibration results.
- Materials used for well installations.
- · Sampling details as outlined in Section 5.0.

Observations or measurements that are taken in an area where contamination of the field notebook may occur may be recorded in a separate bound and numbered logbook before being transferred to the project notebook. The original records are retained, and the delayed entry is noted as such.

Field notebooks are intended to provide sufficient data and observations to enable participants to reconstruct events that occur during projects and to refresh the memory of the field personnel if called upon to give testimony during legal proceedings. In a legal proceeding, notes, if referred to, are subject to cross-examination and are admissible as evidence. The field notebook entries should be factual, detailed, and objective.

Corrections to Documentation

Unless restricted by weather conditions, all original data recorded in field notebooks and on sample identification tags, chain-of-custody records, and receipt-for-samples forms are written in waterproof ink. These accountable serialized documents are <u>not</u> to be destroyed or thrown away, even if they are illegible or contain inaccuracies that require a replacement document.

If an error is made on an accountable document assigned to one person, that individual may make corrections simply by crossing out the error and entering the correct information. The erroneous information should not be obliterated. Any error discovered on an accountable document should be corrected by the person who made the entry. All corrections must be initialed and dated.

Photographs

For all photographs taken, a photographic log is kept; the log records date, time, subject, frame and roll number, and photographer. The photographer should review the photographs or slides when they return from developing and compare them to the log to assure that the log and photographs match. It can be particularly useful to photograph the labeled sample jars before packing them into shipping containers. A clear photograph of the sample jar, showing the label, any evidence tape sealing the jar, and the color and amount of each sample can be most useful in reconciling any later discrepancies.

Daily Log Form

The daily log form will be completed by the Supervisory Geologist and the Driller each day and will be the basis for billing. The final log form will serve as a summary and the SAIC Field Manager must sign before borings and wells are accepted. All specifications must be met before the Field Manager will sign.

5.0 SAMPLE MANAGEMENT ACTIVITIES

Strategy and Sequence

As described in Section 4.0, three soil borings will be used to collect samples for analysis and further site characterization. In each boring, samples will be collected using standard 2-foot split-spoon samplers over the 0-10' interval as specified by the Supervising Geologist.

Sample Management

Sample Designation:

Most methods of analysis of environmental samples must be accomplished within a specific amount of time after the collection of the sample. Where required, these timeframes ("holding times") are given in the method. Careful tracking of the analytical status of samples is required to ensure that these holding times are met.

Sample tracking will be accomplished in the field by assigning each sample a unique number as it is collected. This number will be traceable back to the day, time, and site of collection. This number will be recorded on the sample label and chain-of-custody form as well as in the field logbook. A master log of the identification numbers used will be maintained by the on-site Supervisory Geologist. All containers will be labeled prior to actual sampling. Each number or letter provides vital information pertaining to sample identification, as outlined in the following section.

Sample Labels

Labels (see Figure 5-1) will be attached to all sample containers at the time of collection. The label will be completed in indelible ink and contain the following information:

- · Date and time collected
- Purpose of the sample (waste characterization)
- · Type of analysis (-ses)
- · Sample identification number
- · Source and location of sample
- · Project number and title

FIGURE 5-1 SAMPLE LABEL

SAIL.	One Sears Drive, Paramus, New Jersey 07652
Location:	Project No.:
Sample Date/Time	:
Sample No.:	Sample Location:
Analysis:	
Collection Method:	Purge Volume:
Preservative:	
Comments:	
	Collector's Initials:

- · Method of collection (i.e., bailer, etc.)
- · Name or initials of collector.

Sample Numbering

The sample number system identifies four (4) characteristics of the sample, for example:

The purpose of analysis represents whether the sample is for one of the following:

- · SC Soil Characterization
- FB Field Blank
- · EW Equipment Wash

The SAIC borehole number specifies the origin of the sample, according to soil boring locations by SAIC. The sample number is the sequential number in which the sample was taken.

Duplicates

Duplicate samples will be indicated by the letter D, following the sample number.

Example:

SC-1-1D

Handling and Shipment

Preparation of Sample Batch for Shipment:

The following is a description of the procedures that will be followed when transporting environmental samples from the site to the laboratory:

- · The outer surface of all containers is cleaned with potable water and paper towels.
- Sample collection points, depth increments, and sampling devices are identified and documented in the Field Logbook.
- Logbook entries, sample tags, chain-of-custody forms and field record sheets with sample identification points, data, time, and names or initials of all persons handling the sample in the field are completed, according to this section.
- · Custody tape is wrapped around the cap and neck of each sample container.
- Samples are wrapped in bubble wrap to avoid breakage during shipment and placed in ziploc bags.
- Samples and trip blanks are placed into a thermally insulated cooler along with ice packed in ziploc bags. After cooler is filled, the appropriate chain-of-custody form is placed inside the cooler in a ziploc bag attached to the inside of the cooler lid.
- The cooler is then sealed with duct and strapping tape, in a single strip, around the outside of each cooler.
- · Custody seals are then placed on the outside of the cooler to detect tampering.
- · Appropriate labels and Federal Express form are attached to shipment cooler.

Shipping Containers

Samples will be packaged in thermally insulated, rigid coolers, according to DOT specifications 173.510 and 172 Subparts B, C, and D, and Subparts A and B of Part 173. Sample containers are placed in the cooler which contains ice and absorbent packaging for liquids or styrofoam packing for solids, and maintained at 4°C during shipment. The completed chain-of-custody form is placed inside of the shipping container, unless otherwise noted.

Marking and Labeling

The cooler will be marked as follows:

- Proper shipping name: Hazardous substance, liquid, or solid
- · Hazardous class: To be determined (label placed in upper left corner of outer container)
- Labels: "This Side Up" or arrows placed on the opposite side of the outer container if a liquid is to be shipped

Custody tape is wrapped twice, in a single strip, around the outside of each cooler.

A hazardous material shipper's certification will be filled out and accompany the shipment. The container will be secured with strapping tape to prevent leakage.

Shipping Addresses

Samples will be shipped to:

Lockheed Analytical Laboratories 975 Kelly Johnson Drive Las Vegas, NV 89119-3705

ATTN: Paul Sturtz, Sample Custodian

Phone: (702) 361-3955 Ext. 220

Documentation

Sample Custody:

A critical aspect of sound sample collection and analysis protocol is the maintenance of strict chain-of-custody procedures. Chain-of-custody procedures include inventory and documentation during sample collection, and shipment and laboratory processing. A sample is considered to be an individual's if the sample is: 1) in the physical possession or view of the responsible party, 2) secured to prevent tampering, or 3) placed in a restricted area by the responsible party. The Supervisory Geologist is responsible for the custody of the samples collected until they have been properly transferred to a courier or directly to the laboratory.

Chain-of-Custody Record:

Chain-of-custody forms will be used to document the integrity of all samples (see Figure 5-2). To maintain a record of sample collection, transfer between personnel, shipment, and receipt by the laboratory, a chain-of-custody form will be filled out for each sample set at each sampling location. The chain-of-custody form will contain the following information:

- Sample number (for each sample in shipment)
- Collection data (for each sample in shipment)
- Time shipment was packed
- Number of containers of each sample

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FIGURE 5-2
CHAIN-OF-CUSTODY FORM

- Sample description (environmental matrix)
- Analyses required for each sample
- Shipment number
- Shipping address of the laboratory
- Date, time and method of shipment
- Spaces to be signed as custody is transferred from one individual to another

SAIC's Supervisory Geologist is responsible for checking the chain-of-custody, including:

- Referencing all applicable blank samples
- Signing the form
- Noting the date and time of shipment
- Inspecting the form for completeness and accuracy

All changes on the chain-of-custody form will be initialed. All necessary copies will be retained by the SAIC Supervisory Geologist.

Transfer of Custody and Shipment:

Samples are to be accompanied by an approved chain-of-custody record. When the possession of samples is transferred, both the individual relinquishing the samples and the individual receiving the samples shall sign, date, and time the chain-of-custody document. This record shall represent the official documentation for all transference of sample custody until the samples have arrived at the laboratory.

Samples will be wrapped with plastic packing material and packed with ice into sturdy, thermally insulated coolers. Packaging and shipping procedures are discussed in detail in this section. Sealed coolers will be transported to an air shipping company for overnight delivery to the laboratory.

Field Logbook:

In addition to the procedures in Section 4.0 concerning documentation, the following should be documented in the field logbook:

· Sample numbers, container types, and preservatives used during particular activities

- List of sampling equipment used
- · Decontamination of equipment
- · Handling and shipment of samples to labs
- · Federal Express pickup times, personnel, Fedex package numbers, and confirmation numbers
- · Incidents that may damage sample integrity.

6.0 DATA QUALITY OBJECTIVES AND ANALYTICAL PROCEDURES

To aid in the preparation of the Demonstration Plan and the Quality Assurance Project Plan, it is necessary to complete an initial soil characterization. The objective of the quality assurance efforts for this waste characterization work is to produce well-documented, defensible data of known quality. This document describes the activities which are intended to ensure sound documentation of procedures and results and to measure and control the precision and bias of the analytical systems within acceptable limits.

Data quality objectives for the measurements (listed in Table 6-1) associated with the soil characterization are presented in Table 6-2. The parameters or analytes chosen for laboratory analysis are based on a remedial investigation of the "Reilly Tar Site", and potential soil constituents that may affect the rate and magnitude of bioremediation. An overall summary of sampling and analysis for the soil characterization study is presented in Table 6-3. A sample preservation and holding time summary is shown in Table 6-4. SAIC has identified PAHs as critical to verify Bioventing technology.

6.1 INTERNAL QUALITY CONTROLS

Reliable analytical measurements of environmental samples require continuous monitoring and evaluation of the analytical processes involved, i.e., quality assurance. The protocols of all analyses conducted will incorporate strict quality control decision criteria designed to produce consistently valid and documented results.

6.1.1 <u>Internal Field Quality Control Checks</u>

Collection and analysis of trip blanks, equipment blanks, and field duplicates are intended as QC checks on the integrity of sample collection and handling procedures and equipment decontamination procedures. Trip blanks and equipment blanks will be prepared using ASTM Type II Reagent grade water and sample bottles randomly selected from the bottles prepared for environmental samples.

All QC samples will be shipped with proper chain-of-custody records along with the field samples. The following QC samples will be collected:

Trip blanks will accompany each shipment of samples collected for volatile organics. The sample is prepared by filling a VOA vial with reagent water at the lab, shipping the blank with the sample bottles to the site, and storing the blank with the bottles. The only parameter that will be analyzed is volatile organics.

TABLE 6-1

SUMMARY OF THE ANALYTES FOR CHARACTERIZING THE REILLY TAR SITE

ANALYTE/PARAMETER	SAMPLE ANALYSIS METHOD
Volatile Organic Compounds	SW-846 Method 8240
Semi-Volatile Organic Compounds	SW-846 Method 3550/8270 3510/8270
Total Petroleum Hydrocarbons	EPA 418.1 Mod. EPA 418.1
Total Organic Carbon	SW-846 Method 9060
Total Inorganic Carbon	SM 415.2M
Nitrate/Nitrite	EPA 353
Ortho-Phosphate	EPA 365.2
Full Metals Scan	SW-846 Method 3060/6010 SW-846 Method 3010/6010
Mercury by CVAA	SW-846 Method 7471 7470
Total Cyanide	SW-846 Method 9010

DATA QUALITY OBJECTIVES FOR WASTE CHARACTERIZATION OF REILLY TAR SITE CONTAMINATED SOIL

PARAMETER	метнор	PRECISION*	ACCURACY*	DATA CAPTURE
Volatile Organic Compounds	SW846 8240	0-25	75-125	90
Semi-Volatile Organic Compounds	SW846 3550/8270 3510/8270	0-30	20-180	90
Total Petroleum Hydrocarbons	EPA 418.1 Mod. EPA 418.1			
Total Organic Carbon	SW846 9060	0-25	75-125	90
Total Inorganic Carbon	SM 415.2M			
Nitrate/Nitrite	EPA 353			
Ortho-Phosphate	EPA 365.2			
Full Metals Scan	SW846 3060/6010 SW846 3010/6010			
Mercury by CVAA	SW846 7471 7470		·	
Total Cyanide	SW846 9010			

NOTES:

- a As Relative Percent Difference (RPD) of field duplicates, or of laboratory matrix spike/matrix spike duplicate pair. These are interim guidelines. Statistical control limits generated by the laboratory will be reported with the analytical data.
- b As percent recovery range of laboratory martix spikes, unless otherwise noted. These are interim guidelines. Statistical control limits generated by the laboratory will be reported with the analytical data.
- c Valid data percentage of total tests conducted.

Sources:

EPA-600/4-79-020: Methods for Chemical Analysis of Water and Wastes

SW846: Test Methods for Evaluating Solid Wastes, Third Edition

SM: Standard Methods

OVERALL SUMMARY OF REQUIRED SAMPLING FOR SOIL CHARACTERIZATION AT THE REILLY TAR SITE

Analytical Parameter	Type of Sample	No. of Samples	Sample Size	Preservation	Container	No. of Field Duplicates	No. of Equipment Blanks	No. of Trip Blanks
Volatile Organic Compounds	Grab	15	40 g	4°C	glass VOAs	3	1	1
Semi-Volatile Organic Compounds	Grab	15	40 g	4°C	glass VOAs	3	1	
Total Petroleum Hydrocarbons	Grab	15				3	1	
Total Organic Carbon	Grab	15	40 g	4°C	glass	3	1	
Total Inorganic Carbon	Grab	15				3	1	
Nitrate/Nitrite	Grab	15				3	1	
Ortho-Phosphate	Grab	15				3	1	
Full Metals Scan	Grab	15				3	1	
Mercury by CVAA	Grab	15				3	1	
Total Cyanide	Grab	15				3	1	

TABLE 6-4
SOIL CHARACTERIZATION SAMPLE PRESERVATION AND HOLDING TIME SUMMARY

Parameter	Laboratory	Minimum Volume Required for Analysis	Container	Preservation	Holding Time
Volatile Organic Compounds	Lockheed	40 g	glass VOA	4°C	14 days
Semi-Volatile Organic Compounds	Lockheed	100 g	amber glass	4°C	14 days for extraction 40 days after extraction for analysis
Total Petroleum Hydrocarbons	Lockheed			,	
Total Organic Carbon	Lockheed	40 g	glass	4°C	28 days
Total Inorganic Carbon	Lockheed				
Nitrate/Nitrite	Lockheed				
Ortho-Phosphate	Lockheed				
Full Metals Scan	Lockheed				
Mercury by CVAA	Lockheed				
Total Cyanide	Lockheed				

- · One set of equipment blanks will be collected and analyzed for all parameters sampled.
- All parameters will be collected for duplicate sampling and shall be collected independently at the same sampling location during a single act of sampling. Duplicate samples will be collected as a means of assessing the precision of the sample collection and analytical procedures.

6.1.2 Internal Laboratory Quality Control Checks

The laboratory routinely analyzes QC check samples equivalent to 5 to 10 percent of sample load for each analysis and/or laboratory function. Matrix spikes and matrix spike duplicate analyses are performed once every 10 samples. Method blanks will be analyzed with each batch of prepared samples.

APPENDIX A

Battelle Corp.'s Work Plan for Bioventing SITE Demonstration

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April 17, 1991

FEDERAL EXPRESS

Richard C. Brenner Chief, Biosystems Engineering Section U.S. Environmental Protection Agency 26 West Martin Luther King Cincinnati, Ohio 45268

Dear Richard:

Enclosed please find five copies of the draft work plan entitled "Field Demonstration Project: Bioventing For Enhanced Degradation of PAH Contamination at The Rielly Tar Site". Three copies are for distribution to yourself, Fran, and Paul. The other two copies are for the SITE Program and the City of St. Louis Park. Sorry these took longer than I had anticipated but I wanted to have the document reviewed prior to sending you these copies.

If you have any questions or comments, please do not hesitate to call me at (614) 424-5715 or Robert Hinchee at (614) 424-4698. We look forward to proceeding with this work assignment and hope all parties are in agreement with the effort outlined in the work plan.

Sincerely yours,

Bruce Callman

Bruce C. Alleman. Ph.D.
Research Scientist/Environmental Engineer
Environmental Technology Department

BCA: bca

Enclosure

Bioventing PAH demonstration Project At Rielly Tar Site St. Louis Park. Minnesota

Yearly Budget

		YEAR 1	YEAR 2
	Supplies	\$ 5,000.00	\$ 1,500.00
	Travel	\$ 10,850.00	\$ 13,900.00
	Laboratory Analyses	\$ 11,504.00	\$ 11,504.00
	Labor & Overhead	\$ 47,000.00	\$ 49,000.00
Misc.	Direct costs	\$ 4,848.00	\$ 5,054.00
	Fee	\$ 753.00	\$ 785.00
	TOTALS	\$ 79,995.00	\$ 81,743.00

WORK ASSIGNMENT No. 17(51) WORK PLAN

FIELD DEMONSTRATION PROJECT; BIOVENTING FOR ENHANCED DEGRADATION OF PAH CONTAMINATION AT THE RIELLY TAR SITE

St. Louis Park, Minnesota

Work Assignment Manager - Richard Brenner
Task Manager - Paul McCauley

SCOPE

The objective of this test plan is to establish a field-scale demonstration plot to evaluate bioventing as a means of remediating soils contaminated with polycyclic aromatic hydrocarbons (PAHs). Bioventing is a process which provide indigenous microorganisms with oxygen to aerobically degrade the target contaminants. The aspects of bioventing that make it an attractive treatment technology are:

- bioventing promotes destruction of the compounds in situ
- bioventing produces no additional waste streams that might require additional treatment
- bioventing systems are of a simple design and are not constrained by weather conditions.
- bioventing is less expensive than other conventional treatment alternatives.

This study will involve delineating an oxygen deficient region in contaminated soil, pumping air into this region, and monitoring oxygen utilization and PAH degradation over a period of time. This effort will seek to provide adequate aeration



to maintain soil oxygen levels sufficient for supporting maximum PAH degradation. The results of this study will indicate the potential for using bioventing as a cost effective treatment technology for remediating PAH contaminated soil.

The first phase of the study will include extensive sampling of the soil gas in contaminated area shown in Figure 1 to determine where oxygen (O₂) concentrations are depleted and carbon dioxide (CO₂) levels are elevated. A soil gas permeability test and an initial respiration test will be conducted in order to determine the radius of influence of the air injection vent, and to characterize the subsurface microbial activity. Pending the results of the soil gas survey and the soil gas permeability and in situ respiration tests, and upon verification of PAH contamination, the field demonstration project will proceed.

The field demonstration project will include the initial site characterization described above, installation of an air injection system and a network of soil gas sampling probes, aeration of the subsurface, subsequent sampling the soil gas to monitor biological activity, and a final site characterization to determine the extent of PAH remediation.

The parties involved in this study include the U.S. EPA Biosystems Program, the U.S. EPA SITE Program and its contractor (SAIC), and Battelle. The responsibilities of each party are summarized in Table 1 and will be detailed throughout this Work Plan.

Bioventing Field Demonstration Activities

The bioventing field demonstration project will be conducted in four phases including:

- Phase I. Site characterization
- Phase II. System installation
- Phase III. Site operation and sampling
- Phase IV. Data analysis and report writing

Figure 1. Site Map Showing Contaminated Region Under Consideration For The Bioventing of PAH Demonstration Project.

Table 1. Bioventing Component Yearly Monitoring and Summary.

	SITE P	rogram	Battelle		
	Year 1	Year 2	Year 1	Year 2	
Demonstration plot border	0	0	1	0	
Field office trailer	1	1	0	0	
Sprinkler system	0	0	1	0	
2" groundwater level well	1	0	0	0	
Soil gas probes and feed tubing	36	0	0	0	
Air injection/sample vent and feed line	1	0	0	0	
Gastech gas analyzers	0	0	*	0	
40-channel data logger	0	0	*	0	
1/3 hp air injection pump	0	0	*	0	
Electronic water level sensor	0	0	1	0	
Thermocouple assembly and feed wire	0	0	12	0	
Control panels	0	0	1	0	
Pneumatic couplers and adapters	0	0	40	0	
Soil samples and analyses	72	72	24	-24	
In situ respiration tests	0	0	4	4	
Soil gas O ₂ analysis	0	0	1325	- 1250	
Soil gas CO ₂ analysis	0	0	1325	1250	
Microbial enumeration	0	0	8	8	
Cost Purchased in FY 1991			79,585	80,735	

* Purchased in FY 1991

Phase I will be completed in within the first month of the project. Phase II will be initiated immediately following analysis of the data from Phase I and approval to proceed from all concerned parties. Phase III procedures will begin immediately following completion of Phase II, with the system expected to be in operation for up to two years. Phase IV will be conducted following completion of the technical effort.

Phase I. Site Characterization

Soil Gas Survey

A soil gas survey will be conducted prior to locating the vent well and monitoring points. The survey will be a conducted to define both the vertical and horizontal extent of the oxygen depleted region within the contaminated area.

Accessibility to the site will be confirmed, along with possible restrictions that may hamper the tests. Existing groundwater and soil gas monitoring wells near the test area will be identified. Groundwater will be checked for free floating product, and soil gas from any existing monitoring points or wells will be analyzed for O₂ and CO₂ before proceeding with the soil gas survey. To assist in the soil gas survey, a simple sampling grid will be established using existing monitoring wells or prominent landmarks for identification.

Soil gas sampling will be conducted using small-diameter (5/8"-inch OD) stainless steel probes (KVA Associates or equivalent) with a slotted well point assembly. The probes will be hand-driven to depths of approximately 6, 9, and 12 feet depending on the depth to groundwater. Soil gas at each depth will be withdrawn and analyzed for O_2 and CO_2 using GasTech 3252OX gas analyzers. An uncontaminated site also will be located to be used as an experimental control to monitor background respiration of natural organic matter and inorganic sources of CO_2 .

Prior to obtaining soil gas samples, the probes will be purged with a sample pump to assure representative gasses are withdrawn from each depth. To determine adequate purging time, soil gas concentrations will be monitored until the concentrations stabilize.

Soil Gas Permeability Test

The purpose of conducting a soil gas permeability test is to estimate the radius of influence from injecting air into a single vent well. Prior to initiating the soil gas permeability test, the site will be examined for any wells (or other structures) that will not be used in the test which may serve as vertical conduits for gas flow. These will be sealed to prevent short-circuiting and to ensure the validity of the soil gas permeability test.

Soil gas samples will be collected from the vent well, the background well, and all monitoring points, and analyzed for O₂ and CO₂. After the air injection system has been connected to the vent well and the power has been hooked up, a brief system check will be performed to ensure proper operation of the blower and the pressure and airflow gauges, and to measure an initial pressure response at each monitoring point. This test is essential to ensure that the proper range of Magnehelic^m gauges are available for each monitoring point at the onset of the soil gas permeability test. Generally, a 10- to 15-minute period of air extraction or injection will be sufficient to predict the magnitude of the pressure response, and the ability of the blower to influence the test volume.

After the system check, and when all monitoring point pressures have returned to zero, the soil gas permeability/radius of influence test will begin. Two people will be required during the initial hour of this test. One person will be responsible for reading the Magnehelic^{ne} gauges, and the other person will be responsible for recording pressure (P') vs. time. The following test sequence will be followed:

- 1. Connect the Magnehelic[™] gauges to the top of each monitoring point with the stopcock opened. Return the gauges to zero.
- 2. Turn the blower unit on, and record the starting time to the nearest second.
- 3. At 1-minute intervals, record the pressure at each monitoring point beginning at t = 60 s.
- 4. After 10 minutes, extend the interval to 2 minutes. Return to the blower unit and record the pressure reading at the well head, the temperature readings, and the flow rate from the vent well.

- 5. After 20 minutes, measure P' at each monitoring point in 3-minute intervals. Continue to record all blower data at 3-minute intervals during the first hour of the test.
- 6. Continue to record monitoring point pressure data at 3-minute intervals until the 3-minute change in P' is less than 0.1 in. of H₂O. At this time, a 5- to 20-minute interval can be used. Review data to ensure accurate data were collected during the first 20 minutes. If the quality of these data is in question, turn off the blower, allow all monitoring points to return to zero pressure, and restart the test.
- 7. Begin to measure pressure at any groundwater monitoring points that have been converted to monitoring points. Record all readings, including zero readings and the time of the measurement. Record all blower data at 30-minute intervals.
- 8. Once the interval of pressure data collection has increased, collect soil gas samples from monitoring points and the blower exhaust (if extraction system), and analyze for O₂, CO₂, and hydrocarbons. Continue to gather pressure data for 4 to 8 hours. The test will normally be continued until the outermost monitoring point with a pressure reading does not increase by more than 10% over a 1-hour interval.
- Calculate the values of k and R_I with the data from the completed test using the HyperVentilateTM computer program. The Appendix shows sample calculation methods for determining k and R_I.

Immediately after completion of the permeability test, soil gas samples will be collected from the vent well, the background well, and all monitoring points, and analyzed for O_2 and CO_2 concentrations. If the O_2 concentration in the vent well has increased by 5% or more, O_2 and CO_2 will be monitored in the vent well in a manner similar to that described for the monitoring points in the *in situ* respiration test (Initial monitoring may be less frequent). Monitoring gas concentrations in the vent well will provide additional *in situ* respiration data for the site.

In Situ Respiration Test

The *in situ* respiration test will be conducted at four nodes and a background point using 5/8" OD stainless steel monitoring probes inserted to a depth corresponding

with the PAH contamination and oxygen depletion. The results from this test will indicate if in situ microbial activity is occurring and if it is O_2 -limited.

Air with 1 to 2% helium will be injected into the monitoring points and background well. Following injection, the change of O_2 , CO_2 , and helium in the soil gas will be measured over time. Helium will be used as an inert tracer gas to assess the extent of diffusion of soil gases within the aerated zone. The background monitoring point will be used to monitor natural degradation of organic matter in the soil. A schematic of the apparatus to be used for the *in situ* respiration test is presented in Figure 2.

Prior to air injection, the O₂ and CO₂ levels will be measured at each of the monitoring points. Air will be injected into the ground for at least 24 hours at rates ranging from 60 to 100 cfh using Model 4Z024 diaphragm compressors from Grainger (or equivalent) with a nominal capacity of 100 cfh at 10 psi. The tracer gas will be helium of 99% or greater purity. The helium flow rate will be adjusted to 0.6 to 1.0 cfh to obtain about 1% in the final air mixture which will be injected into the contaminated area. Helium concentrations in the soil gas will be measured with a Marks Helium Detector Model 9821 (or equivalent) with a minimum sensitivity of 0.01%.

After air and helium injection is completed, the soil gas will be measured for O_2 , CO_2 , helium, and total hydrocarbon. Measurement of the soil gas will be conducted at 2, 4, 6, and 8 hours and then every 4 to 12 hours, depending on the rate at which the oxygen is being utilized. If oxygen uptake is rapid, more frequent monitoring will be required. If it is slower, less frequent readings will be acceptable. The various parameters which will be measured and their estimated frequency are presented in Table 2.

The in situ respiration test will be terminated when the oxygen level drops below 5%, or after 5 days of sampling. The temperature of the soil before air injection and after the in situ respiration test will be recorded.

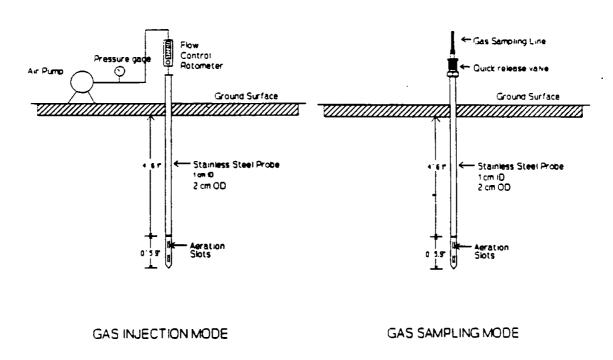


Figure 2. Apparatus used for Conducting In Situ Respiration Tests.

DRAFT

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Table 2. Parameters to be Measured for the In Situ Respiration Tests

Parameter/Media	Suggested Method	Suggested Frequency	Instrument Sensitivity (Accuracy)
Carbon Dioxide/Soil Gas	Infrared adsorption method. GasTech Model 3252OX () to 5% and 0 to 25% CO ₂)	Initial soil gas sample before pumping air, immediately after pump shut off, every 2 hours after the first 8 hours, and then every 8 to 10 hours.	<u>+</u> 0.2%
Oxygen/Soil Gas	Electrochemical cell Method. GasTech Model 3252OX (0 to 21% oxygen)	Same as above	<u>+</u> 0.5%
Helium/Soil Gas	Marks Helium Detector Model 9821 or equivalent	Same as for carbon dioxide	<u>+</u> 0.01%
Pressure	Pressure gauge (0 to 30 psia)	During air injection	0.5 psia
Flow Rate/Air	Flowmeter	Reading taken during air injection	<u>+</u> 5 cfh

Phase II. Site Preparation

Site Preparation will include establishing a well defined experimental field plot that can be operated and monitored over the anticipated extended time period and which is amenable to potential future modifications. Battelle will initialize site preparation by delineating the plot border in an area determined to be oxygen deficient and where PAH contamination is verified. Once the plot border has been established, the following site preparation activities will be carried out by the SITE Program including:

- purchase/rental or loan, delivery, and set up of a construction site office trailer
- installation of a security fence
- delivery of water to the site for installation of a sprinkler system
- installation of temperature and groundwater level monitoring systems
- initial site characterization of test and control plots for PAH concentrations
- installation of the air injection system and soil gas sampling network (Battelle will provide screened section of air vent).

Plot border delineation

In order to better define the experimental plot it will be necessary to establish a defined surface plot borders. This will be done using the results of the initial site characterization. Battelle will insert steel pipe into the ground around the plot perimeter of the demonstration plot and mark each pipe with a colored reference flag.

Field office trailer

The SITE Program will provide a construction trailer to be located adjacent to the test plot. The trailer will serve as a field office and an equipment storage facility. The Site program will run electricity to the trailer for pump operation, heating, and lighting. Battelle will provide steel storage cabinets to provide a work surface as well as

to store equipment, the air injection pumps, and the control panels. Gas sampling and temperature monitoring will be done from inside the trailer.

Security fence

The SITE Program will provide a security fence with a locking gate to the site. The fence will be placed so as to allow movement around the outside of the plot perimeter and the installation of a field office trailer. The height of the fence will meet local regulatory codes.

Water Supply

The SITE Program will provide water to the site. Battelle will provide irrigation equipment to control soil moisture.

Monitoring system installation

Included in the plot design are monitoring systems for subsurface temperature and groundwater level. Both systems will be installed by the SITE Program after the construction of the plot cover. The temperature system will consist of a series of type J thermocouples connected to a 40 channel multi-point trend recorder which will be provided by Battelle. The thermocouples will be placed at 3 depths in the area of the four selected gas sample probes shown in Figure 3. The recorder will be placed inside the field trailer and connected to the thermocouples with the appropriate wire.

The groundwater level monitoring system will consist of a 2-in Schedule 40 PVC pipe. The screen will penetrate 4+ ft into the saturated zone and will extend upward to within 2½ ft of ground level. A high quality bentonite grout should extend from the ground surface to a depth of 2 ft. The top of the casing will be sealed with an air tight plug. Water levels will be determined manually with an electronic water level detector.

Initial site characterization

To determine the depth for placement of the air injection vent and the sampling probes, the depth to groundwater will be determined. The SITE Program will

EXTERNAL SOIL GAS SAMPLING PROBE

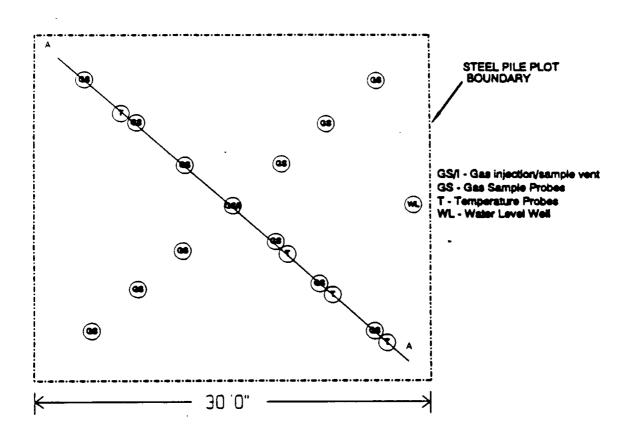


Figure 3. Bioventing field demonstration plot plan showing relative locations of the gas injection/sample probe, gas sample probes, temperature monitoring system, and water level well.

obtain initial soil samples during the installation of the bioventing system. Samples will be taken from the bore holes of the gas sample probes at depths corresponding to gas withdrawal. To obtain a no-treatment control, a set of soil samples will be procured from the anoxic zone of the control plot. All soil samples will be analyzed for PAH concentrations.

Bioventing system installation

The SITE Program will install the bioventing system at the Rielly Tar Site according to the protocol developed by Battelle. One 2-in. PVC air injection vent will be inserted into the contaminated soil in the center of the demonstration plot. The plot dimensions will be approximately 30-ft X 30-ft. The bottom 5-ft of the vent will be screened and the vent placed so that 3-ft to 4-ft are below the water table (Figure 4). The top 5-ft of the bore hole will be sealed with bentonite.

The injection vent will be connected to ½-in. stainless steel tubing (or equivalent) which will be fed to a control panel located in the office trailer. At the control panel, the stainless steel tubing will be connected to a three-way ball valve which will allow selection of either an air injection or a gas withdrawal line. The air injection line will be connected to a 1/3-hp diaphragm pump. The gas withdrawal line will be fitted with a quick release pneumatic coupler.

Soil gas sample network

network of soil gas sampling probes. The network will consist of 36 gas sample probes each consisting of a 3-in. screened sections of 4-in. ID Schedule 80 PVC pipe, air-tight PVC caps, and 1/8-in. stainless steel tubing (or equivalent) (Figure 5). Each section of pipe will be screened by drilling enough holes to allow maximum air flow to the stainless steel tubing. The stainless steel tubing will be fed through the top cap of each section so the end of the tube is approximately in the center of the PVC section. Three probes will be attached to a ½-in. PVC pipe at spacing to be determined after the depth to the groundwater has been determined. The pipe and three probes are to be set in the same

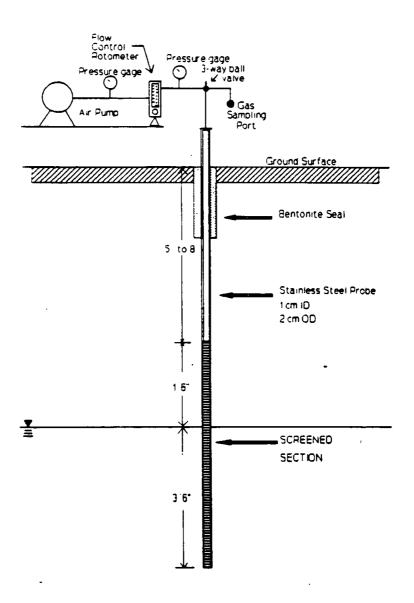


Figure 4. Schematic of the air injection/sample system to be installed in the bioventing field demonstration plot at the Rielly Tar Site in St. Louis Park, Minnesota.

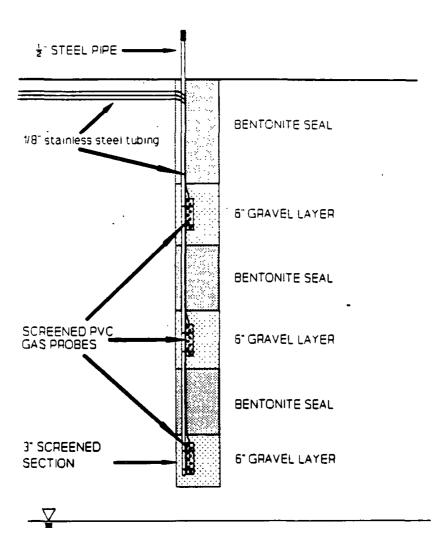


Figure 5. Schematic of the gas sample probes to be installed in the bioventing field demonstration plot at the Rielly Tar Site in St Louis Park, Minnesota.

bore hole at each of the 12 ion ations as shown in Figure 4. The hole will be back filled with 6-in, of sand at probe depths and bentonite between probe depths and to ground level. All stainless steel tube lines will be run 6-in, below grade to the office trailer.

The 1/8-in. stainless steel tubing from all 36 probes will be fed to a control panel in the operations trailer. At the control panel, tubing from each probe will be connected to a quick release pneumatic coupler for gas-tight attachment of the gas sampling analyzers.

Phase III. Site Operation and Sampling

Battelle will be responsible for the operation of the site. City personnel will provide routine site operation including inspection of all equipment, monitoring subsurface temperature and groundwater level, and measuring O_2 and CO_2 in the soil gas. Soil samples will be obtained by the SITE Program at time zero, one, and two years, and sent to their contracted laboratory for analysis of PAH concentrations. In addition, Battelle will take up to 24 intermittent samples per year for PAH and microbial analyses.

Site monitoring

Subsurface O_2 and CO_2 levels, temperatures, depth to groundwater, and soil moisture will be monitored every two weeks by personnel provided by the City of St. Louis Park and trained by Battelle. Any significant variations in these parameters will be immediately reported to Bruce Alleman of Battelle and Paul McCauly of the U.S. EPA Biosystems Program.

Venting

Air injection will be continuous except during the time of the scheduled respiration tests when the pump will be turned off. One diaphragm compressor air pump will be connected to the air injection/sample vent in the center of the plot assuring gastight conditions. Venting will consist of injecting approximately 100 ft³-air/hr. The blower and air injection system will be designed to inject from 10 to 200 ft³-air/hour. Gas

flow rates and pressures will be monitored every two weeks by Battelle. In the event of excess variation in either flow rate or pressure, Battelle will take corrective measures and immediately notify Paul McCauly.

In-situ respiration tests

Four *in-situ* respiration tests will be conducted by Battelle during each of the two years of operation. These tests will entail shutting down the air injection pump, switching the three-way valve to the extraction position, and monitoring the soil gas for up to 5 days. Up to four soil gas samples from each probe will be will be analyzed per day for O_2 and CO_2 content (approximately 500 total samples/respiration test). At the completion of the respiration test, the air injection pump will be turned on and the system returned to normal operation.

Soil sampling

The total number of soil samples to be collected by the SITE Program during the installation of the gas sampling system and at the end of the second year of operation is 150. This number is subject to change if statistical analysis of data obtained from preliminary soil samples indicates more or less extensive sampling is required to determine degradation performance.

Four probe locations in the treatment plot and the control plot will be sampled in triplicate both before and after venting. Soil samples will be taken from the corresponding depths of gas sample withdrawal at each of the 3 gas sample probes at each node as well as the air injection/sample vent locations.

Each sample will be collected from a distance of 1-ft away from the gas sample probes in the pattern shown in Figure 6. After obtaining the required volume of soil, the bore holes will be back filled with the soil removed during sample collection and the sampling location marked. The samples will be analyzed by a CLP laboratory selected by the SITE program for the parameters listed in Table 3. The same laboratory will be contracted to conduct the PAH analyses on all soil samples taken during this demonstration project.

PROPOSED SAMPLING SCHEME

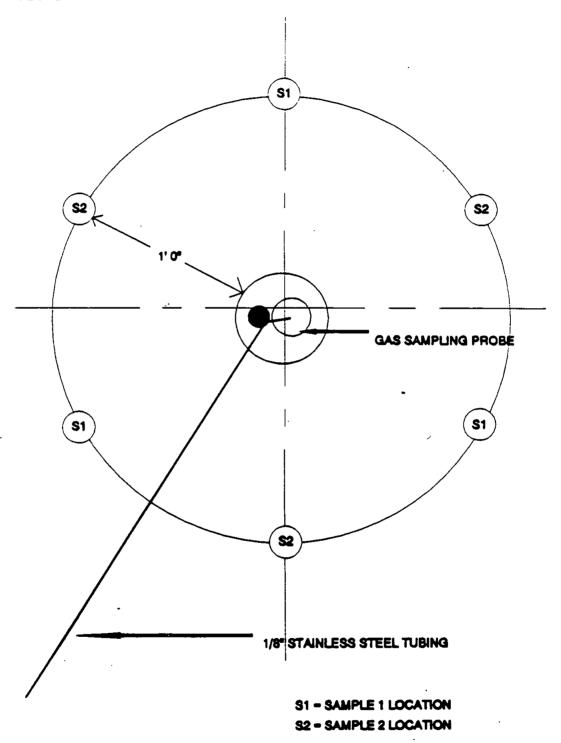


Figure 6. Schematic showing sampling protocol around each sample node for sampling prior to venting (S1) and after venting (S2).

Table 3: Parameters to be determined for soil, soil gas, and ground water samples from the Rielly Tar Site bioventing demonstration plot.

20

	Soil (150 samples)	Gas (2575 samples)
Percent O ₂	-	+
Percent CO ₂	•	+
pH	+	•
Alkalinity	+	•
Cation exchange capacity	+	•
Nutrients (C,N.P,K)	2 samples-92 3 samples-93	-
Metals	+	+
Moisture content	+	-
PAH concentrations	+	<u> </u>
Particle size distribution	+	•
Microbial enumeration	8 samples-92 8 samples-93	-

Groundwater sampling

Groundwater sampling will not be done during this effort.

Soil gas sampling

During venting system installation, each gas sampling probe will be connected to 1/8-in stainless steel tubing (or equivalent) which will be fed to the control panel located in the field trailer. At the control panel, the stainless steel tubing will be fitted with gas-tight quick-release valves. Soil gas will be sampled and analyzed inside the trailer at the control panel by connecting the gas analyzers to the quick-release pneumatic couplers from each probe.

Prior to venting, initial gas samples will be analyzed for percent O_2 and CO_2 using a Gastech Model 3252OX gas analyzer with a range of 0 to 5% for CO_2 and 0 to 25% for O_2 . Gas samples will be withdrawn at 750 ml/min for several minutes in order to flush all the probe and tubing gas before taking a reading. O_2 and CO_2 concentrations will be determined for all sampling locations prior to the commencement of air injection.

Once air injection has begun, routine gas samples will be withdrawn and analyzed for O_2 and CO_2 . Gas will be withdrawn and analyzed from the air injection/sampling vent by switching the three-way valve to the extraction position. Gas sampling at the gas sample probes will use the same method as the initial gas sampling. Soil gas composition will be measured every two weeks by Battelle.

Final site characterization

At the conclusion of the field plot operation, the SITE Program will procure a final set of soil samples, the number of which will be determined following preliminary soil sampling. The samples will be taken from each gas sampling node at the depths of gas withdrawal as described in the initial soil sampling protocol. The set of control soil samples taken from the control plot in an anoxic zone outside the sphere of influence of the venting activity will be used to compare degradation performance with and without

bioventing. All samples will be analyzed by the SITE Program for residual PAH concentrations.

Phase IV. Data Analysis and Report Writing

Monthly progress reports which summarize the technical progress, discuss problems encountered, and project future progress will be submitted by Battelle to the U.S. EPA Biosystems Program, The U.S. EPA SITE Program, U.S.EPA Region 5, the State of Minnesota EPA, and The City of St. Louis Park. In addition, an annual progress report will be submitted by Battelle to the above mentioned parties at the end of the first year of operation to present data and any conclusions for the previous year's work.

A draft final report for the field demonstration project will be submitted by Battelle to the above mentioned parties within 90 days of completion of the technical part of the study. Said parties will have 30 days to submit their review comments to Battelle. Battelle will then produce a final report incorporating pertinent review comments and changes within an additional 30 days. The report will include all data collected during the field demonstration project including data tables containing temperature, water level, O₂ and CO₂ concentrations, initial and final PAH concentrations, and initial and final microbial cell counts. In addition to all data and measurements taken during the study, the report will include analysis of the results and conclusions regarding the effectiveness of bioventing in enhancing the *in-situ* biodegradation of PAH contaminants. Recommendations for future work including nutrient addition, pH adjustment, and temperature control will be presented in the report.

Data Sharing

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The City of St. Louis Park initiated a RIFS study at the Rielly Tar Site in 1990. It is critical that all parties have access to the data from earlier site studies to speed progress on system installation and facilitate comprehensive data evaluation and reporting. It is understood as part of this joint project that U.S. EPA and the City of St. Louis Park

will be provided with timely copies of all progress reports and data generated from the other party's component of the overall project. The city of St. Louis Park will have the right to use and/or publish U.S. EPA-sponsored data in any fashion it deems appropriate. Likewise, U.S. EPA reserves the right to use any city of St. Louis Park-sponsored data in any publications developed as a result of this work. Such publications, although primarily emphasizing U.S EPA-generated results, will likely also include summaries of City of St. Louis Park-generated data to produce an integrated and coherent interpretation of project findings. City of St. Louis Park generated data will be acknowledged in any U.S. EPA publications.

U.S. EPA reporting of findings may take the form of U.S. EPA reports (published through the National Technical Information Service), articles in technical journals, U.S. EPA newsletters and bulletins, proceedings of symposia and workshops, and oral presentations and lectures. Reports and/or articles will be prepared by U.S. EPA at the end of the project; interim results may also be reported or published at appropriate milestones throughout the project. It is recommended that draft copies of any intended joint project publications by either party be provided to the other party for their prepublication/pre-presentation review.

Schedule

An approximate work schedule is presented in Table 4.

Health and Safety Considerations

No unusual risks are expected as a result of the bioventing demonstration project activities.

Post-demonstration Activities

The SITE Program will be responsible for the disposal and/or treatment of residuals from the field demonstration study.

Approximate Schedule for Set Up and Operation of the Bioventing Table 4. Demonstration Project at the Rielly Tar Site.

Date	Activities
Time 0	Battelle to forward Work Plan to the EPA Biosystems Program & SITE Program and SAIC
Weeks 1-2	Phase I. Site visit and initial site characterization
Weeks 3-6	Phase II. Site preparation and initial soil sample collection
Week 7	Phase III. Site operation and sampling
Week 7	Initial gas profile and start up of bioventing system
Weeks 7-19	Routine operation and monitoring of the bioventing demonstration filed plot
Week 20	In situ respiration test #1
Week 32	In situ respiration test #2
Week 44	In situ respiration test #3 -
Week 56	In situ respiration test #4
Weeks 57-60	Data analysis and progress report writing for year 1
Week 68	In situ respiration test #5
Week 80	In situ respiration test #6
Week 92	In situ respiration test #7
Week 104	Shut down of air injection system
Week 104	In situ respiration test #8
Week 104	Final soil sample collection and analyses
Weeks 105-109	Phase IV. Data analysis and final report writing

verbal schedule

Shows 5 months 90 days draft

30 " - review

30 " - final

Quality Assurance

This effort is an EPA Category II quality assurance project. A quality assurance project plan (QAPP) will be designed for this study. The QAPP will address quality assurance (QA) objectives, sampling and analytical procedures, and the organizational approach to QA.

APPENDIX B

DRILLING SUBCONTRACTORS STATEMENT OF WORK

STATEMENT OF WORK SOIL BORING INSTALLATION AT REILLY TAR SITE ST. LOUIS PARK, MINNESOTA

Science Applications International Corporation (SAIC) will be conducting a research project at the Reilly Tar Site, St. Louis Park, Minnesota, as part of the United States Environmental Protection Agency's (USEPA) Superfund Innovative Technology Evaluation (SITE) Program. As a part of a subsurface contaminant study in support of a demonstration investigation of an innovative hazardous treatment technology, a drilling subcontractor is required to install three (3) soil borings. SAIC is requesting price quotations from a subcontractor capable of performing the work specified in Section 3.0 of this Statement of Work (SOW). Questions concerning this request for qualifications should be addressed to Michael M. Bolen at (516) 282-7378.

1.0 SITE BACKGROUND

Between 1917 and 1972, the Reilly Tar & Chemical Corporation operated a coal tar distillation and wood preserving plant known as the Republic Creosote Company, in St. Louis Park, Minnesota. Spills and discharge of contaminated wastewater at the Reilly Tar Site have caused extensive ground water contamination resulting in the closure of six municipal wells in St. Louis Park and one in Hopkins.

The major constituents of coal tar are phenolic compounds and polynuclear aromatic hydrocarbons (PAH). Some PAH compounds are

expected to range between 0 to 10,000 ppm. In addition, concentrations of phenols, total petroleum hydrocarbons, and benzene extractables are evident on-site.

1.1 SUMMARY OF SERVICES TO BE PROVIDED

The Driller shall drill and install three (3) soil borings, and conduct related work in accordance with Sections 1.5 through 4.0. One truck-mounted or trailer drill rig will be required. The rig must be free of existing oil and hydraulic fluid leaks and mechanically sound to complete the work without delay. The rig should also be equipped with a spark arrestor, as well as any support equipment (e.g., steam cleaner). In addition, support trucks may be necessary to complete the task. The following describes the fixed scope of work:

- Drill 3 soil borings not to exceed a total of 30 linear feet using hollow-stem auger drilling methods.
- Standard split-spoon samplers shall be used to collect 15 soil samples continuously.

1.2 INVOICING AND PAYMENT

Work directed by SAIC and conducted by the Driller outside of the fixed scope will be considered to be a change in scope. SAIC will pay the Driller the fixed price amount as compensation for completion of the fixed scope of work. A monthly payment will be made upon the Driller's acceptable completion of the work to that date and SAIC's receipt of a correct invoice. The invoice will be accompanied by signed daily well completion forms provided to the Driller on-site.

1.3 SCHEDULE AND TERM

The soil boring services are estimated to be conducted during the week of August 10, 1992. Extension of this agreement will be as mutually agreed upon by SAIC and the Driller. The estimated start date for soil drilling and sampling is August 12, 1992. Work days will average 8 hours in length dependent on weather conditions. Extension of the specified performance timeframes of the term of this agreement will be as mutually agreed upon in writing by SAIC and the Driller.

1.4 LIQUIDATED DAMAGES

The Driller may be liable for payment of liquidated damages in the event that the Driller does not complete the work in accordance with Sections 1.5 - 4.0 to the extent that SAIC deems the late completion to be the result of errors or to other actions or inactions on the part of the Driller. The rate of liquidated damages will be \$800 per business day and will serve as compensation to SAIC for SAIC's cost of extending the date of completion of the work.

1.5 MINIMUM CRITERIA

Subcontractors must meet the following minimum criteria in order to be considered responsive and must maintain these minimum criteria throughout the drilling program:

- 1. Be licensed in an appropriate classification (for the specific work responded to by offerer) with the State of Minnesota. Proof of License must be submitted with bid response to be considered responsive. License must be current and active at the time of bid response and throughout the term of performance. In addition, offerer must present proof of insurance with bid response, as well.
- 2. Must be familiar with and adhere to the State of Minnesota well and boring construction standards as they apply to monitoring well installation, construction and development.
- 3. Be capable of providing one (1) drill rig in compliance with the drilling specifications and a dedicated crew for the length of the operation.
- Drilling crew members are required to have 40 hours certification for Hazardous Waste Site Operations, as required by OSHA. <u>Offeror must submit proof of OSHA</u>

certification plus 8-hour refresher certificates with bid response. In addition, offeror must have full understanding of the details of the EPA personnel protection levels to be used on-site as described in the Health and Safety Requirements, Section 5.0.

- 5. The driller must submit with this bid response proof of proper medical examinations as outlined in Section 5.1 and satisfactory respirator fit test results for each employee dedicated to this task.
- 6. Have previous experience in soil boring drilling and installation of wells at hazardous waste disposal sites.
- 7. All drilling rig operators and helpers must be knowledgeable of the requirements necessary to meet the specifications in the entire SOW for the work prescribed.
- 8. The drill rig must be fully operational (e.g., no mechanical problems, leaks, etc.) upon commencement of activities at the site and be equipped to perform all designated sampling. All required drilling-supplied materials and spare parts must be on-site in adequate quantities at commencement of drilling operations.
- 9. All work shall be performed at the direction of SAIC's Supervisory Geologist ONLY.
- 10. All work acceptance will be given by the SAIC Supervisory Geologist <u>ONLY</u>.
- 11. The Driller shall be responsible for securing (including payment of fees) and complying with any and all boring or well drilling permits required by the State of Minnesota and local authorities.
- 12. Technical direction will be provided by SAIC's Field Manager in the field. Technical direction is defined as providing clarification of the Statement of Work, delivery schedule, or any other actions that may affect the subcontract prices. All work shall be performed at the direction of the SAIC Field Manager.
- 13. Notwithstanding any provisions contained elsewhere in the subcontract, SAIC's Contractual Representative is the only person authorized to approve changes in any of the requirements herein. In the event the Driller effects any change at the direction of any person other than SAIC's Contractual Representative, the change will be considered to have been without authority.

1.6 BID PREPARATION ASSISTANCE

The following information is provided in order to assist in the development of price quotations:

- 1. Drilling activities will commence at 7:00 AM. and run to approximately 6:00 PM (with a one hour lunch break), during a normal work week. Operations are expected to begin on August 12, 1992, and to continue over 2 days.
- 2. The Driller shall provide all labor, equipment, and materials necessary to complete the work described herein and presented in Section 4.0.
- 3. Offeror is responsible for providing OSHA-trained employees and to provide each worker with appropriate personnel protection. Safety procedures will be followed during the prescribed task. PLEASE CAREFULLY READ SECTION 5.0 OF THE ATTACHMENT FOR FURTHER GUIDANCE. Workers will be required to wear proper protective clothing during drilling, and decontamination operations. Requirements for Health and Safety procedures will be identified and enforced by the SAIC Supervisory Geologist. The Supervisory Geologist will have the authority to stop drilling operations until compliance with the Health and Safety requirements is achieved.
- 4. A total of 3 soil borings will be drilled to a depth of 10 feet each. Total linear footage for all 3 borings will not exceed 30 feet. These estimates are provided for bidding purposes only.
- 5. The location of all boreholes will be staked by SAIC. These sites will e located based on the review of past records, personal interviews, previous site drilling activities, soil gas surveys, and aerial photographs. Therefore, it is very important to position each borehole as close as possible to its staked location.
- 6. Based on schedules and other drilling operations at the site, the Field Manager will direct each Subcontractor's drilling crew to the appropriate location for the next well or borehole.
- 7. Containerization of drill cuttings and waste materials in new, Department of Transportation (DOT) approved drums will be necessary. The offeror is responsible for providing drums, filling drums, and transporting them to an on-site location designated by SAIC.
- 8. The offeror must be equipped to provide for all potable water and electrical needs should a source be unavailable at the site.

2.0 STANDARDS AND ACCEPTANCE CRITERIA

The purpose of this section of the Statement of Work is to specify standards to be followed and criteria that are required to be met in order for borings to be accepted by SAIC.

2.1 GENERAL

The Subcontractor will be responsible for securing and complying with all well drilling permits required by the State of Minnesota or local authorities. The Subcontractor is responsible for determining and complying with any and all State and Local regulations regarding submission of Intent to Drill forms, drilling logs, and well descriptions.

Any inconsistencies between these specifications and government or responsible agency requirements will be reported to the Supervisory Geologist prior to commencement or continuation of drilling. If the inconsistencies are not reported or are not resolved prior to drilling, then all work performed will be the responsibility of the Subcontractor.

2.2 BORING DRILLING STANDARDS

2.2.1 Decontamination Standards

Decontamination of equipment and personnel will be performed as detailed below:

1. Prior to the commencement of drilling operations and between drilling locations, all drilling equipment, including rods, bits, augers, tools, etc., as well as equipment used for well development, shall be scrubbed with a laboratory-grade detergent (e.g., Alconox or Liqui-Nox) and cleaned with a high-pressure steam cleaner. The scrubbing shall take place at a designated decontamination point. The Driller is responsible for securing the accomplish equipment detergent and to The Driller decontamination of his equipment. responsible for cleaning the decontamination area after each use.

- 2. Split-spoon and other sampling equipment shall be decontaminated between collection of samples by washing with a laboratory-grade detergent, rinsing in potable water, rinsing with ASTM Type II reagent water, rinsing with pesticide-grade methanol, rinsing with pesticide-grade-hexane, and allowed to air dry. Between sampling intervals, sampling equipment will be decontaminated as specified in Item 1, above. SAIC personnel will assist in decontaminating the split-spoons.
- 3. The subcontractor shall be required to collect and contain fluids and waste materials generated by well drilling and development. Containers for solids and liquids shall consist of clean, Department of Transportation (DOT) approved 55-gallon drums with plastic bag liners. A temporary storage area shall be available at the site to act as an accumulation point for generated waste materials.

Drill cuttings determined to be hazardous based on field testing conducted by SAIC shall be drummed.

2.2.2 General Standards

- 1. If water is to be used, only potable water shall be used for drilling operations. The driller should be prepared to provide all the water required to conduct drilling and decontamination activities. It is uncertain whether arrangements can be made beforehand with the Base to make a water source available. The Driller shall provide hydrant connections, hoses, and hydrant keys for accessing water from the designated hydrant source. The Driller will be responsible for hauling water for the duration of the drilling and well installation activities.
- 2. Potable water is the only drilling fluid additive permitted during drilling operations. Permission and approval to use any other additive must be obtained from the SAIC Field Manager prior to any use. Failure to obtain approval prior to the use of any other additive may cause the hole to be deemed unacceptable, requiring a new hole to be drilled or bored or corrective actions to be taken at the Driller's expense. The SAIC Field Manager will determine what method will be used to correct the deficiency.
- 3. Abandonment of any boring must be approved by the SAIC Field Manager. Abandonment shall be accomplished according to the State of Minnesota specifications or as specified by the SAIC Field Manager.

- 4. It shall be the responsibility of the Driller to restore each drilling location and storage area to approximately pre-drilling conditions (as required by the SAIC Field Manager) once work at each location is complete.
- 5. All drill cuttings, regardless of suspected contamination, shall be placed in new, unused, DOT-approved, plastic lined 55-gallon drums, supplied by the Driller and moved to the designated storage area on the site.
- 6. Because of the volatile nature of the contaminants involved, any welding will be performed in the staging area and not over the open hole.
- 7. All waste material (i.e., bags, buckets, plastic, etc.) shall be collected daily and transported by the Driller to an appropriate disposal location, specified by SAIC.
- 8. Soil samples collected for descriptive and analytical purposes will be collected using standard 2-foot splitspoon samplers. Samples shall be collected at intervals specified by the SAIC Supervisory Geologist, although continuous sampling is anticipated. During all soil sampling activities, the driller shall conduct standard penetration tests [ASTM 1586 (1974)]. The drill rig should be equipped with, eight (8) split-spoon samplers, each 2 feet in length. The availability of more samplers will prevent operations from being delayed due to the rigorous decontamination procedures that will be followed during sample collection. Any delays resulting from decontamination preventing or weather decontamination will not be considered stand-by time.

3.0 DRILLING AND SAMPLING PROCEDURES AND SPECIFICATIONS

The objective of this section of the Statement of Work is to specify procedures that are required during the installation of soil borings at the Reilly Tar Site, St. Louis Park, Minnesota.

The following specifications have been based on available site information and EPA requirements. Alternative approaches to drilling and sampling are encouraged and will be considered, but the prepared modifications must be sufficiently detailed, and accompanied by sufficient backup to allow SAIC to comparatively evaluate alternative approaches. All modified approaches presented shall be priced separately from the approaches specified in this package so that a one-to-one comparison can be made of the approaches. SAIC reserves the right to accept or reject any proposed alternative approach.

A total of 3 soil borings will be drilled and installed in the alluvium and fill material at a former wood preserving site. Procedures to be used are outlined in the following section.

Site access will be provided by SAIC. Arrangements will be made for the selected Subcontractor to evaluate the site, check utilities, and stake well locations prior to mobilization to the site, if necessary.

3.1 DRILLING AND SAMPLING PROCEDURES

3.1.1 Drilling and Installation of Soil Borings

The following steps will be performed to drill the soil borings:

- 1. Set up over the staked location and plumb the drill rig.
- 2. A total of 3 boreholes will be advanced to approximately 10 feet below land surface (BLS), each. The actual depth will be determined by the SAIC Supervisory Geologist but should not be more than 1-2 feet more or less than the 10 foot mark.
- 3. Samples shall be collected every 2 feet using 2-foot stainless steel split spoon samplers. Samples will be collected by removing the stem plug, driving the split-

spoon sampler, retrieving the sample and reinstalling the plug. This process shall be repeated until the prescribed number of samples and the total depth of the borehole is reached.

4.0 DRILLING MATERIALS TO BE SUPPLIED BY SUBCONTRACTOR

The Subcontractor will be required to provide the specified drilling materials detailed below:

- 1. Low residue, laboratory-grade detergent (Liqui-Nox, Alconox, or equivalent) for decontamination of drilling and sampling equipment.
- 2. The Subcontractor will be required to supply a steam cleaner for the duration of the drilling program, including an electrical generator.
- 3. The Subcontractor will be required to supply clean, plastic-lined 55 gallon steel drums for contaminated drill cuttings. New DOT-approved 55-gallon drums will be required.
- 4. A water carrier or water truck for the duration of the drilling program. Containers must never have contained anything but potable water.
- 5. Other materials required for drilling and soil sampling.
- 6. The decontamination area must be setup by subcontractor, using a liner and berm to contain wash water. Wash water will be pumped into water storage containers.
- 7. At least six (6) split-spoon samplers, each 2 feet in length, to allow for uninterrupted sampling.

5.0 HEALTH AND SAFETY

This section establishes the Health and Safety measures to be employed during the drilling program at the Reilly Tar Site. The maintenance of good health and the provision for the safety of onsite personnel will be of major concern during the activities at the site. To this end, SAIC has identified both medical surveillance and safety programs which will afford on-site personnel more than adequate protection. The main points of this plan include medical examination and safety equipment use and procedures. Each of these points is described in greater detail in the following sections.

Subcontractors will comply with all Health and Safety requirements of the project Health and Safety Plan. SAIC reserves the right to stop operations if the on-scene SAIC Supervisory Geologist determines that these requirements are not being followed. Any cessation of drilling operations (i.e., downtime) caused by breached health and safety requirements by the Subcontractor will be at the expense of the Subcontractor. Subcontractor and drilling personnel will be expected to have a full understanding of the details of EPA and OSHA personnel protection levels to be used. Subcontractor personnel will be in compliance with OSHA requirements for health and safety training prior to the onset of drilling activities. Documentary verification of training, medical surveillance and fit test records will be required.

Each person will be responsible for complying with this Plan and with the directions of the SAIC Supervisory Geologist.

5.1 MEDICAL SCREENING AND HEALTH EXAMINATIONS

All drilling personnel will undergo health monitoring while participating in the waste site investigations so that their health may be protected through early detection of symptoms of exposure to toxic substances and screening for their physical ability to

perform the job. The health monitoring is accomplished through a system of medical examinations.

All drilling personnel must be participating in a medical surveillance plan. At a minimum, this should include an annual physical examination which includes tests of the sensory system, lungs, liver, kidney and cardiovascular system. The examinations must include, at a minimum, the items detailed below:

- 1. Previous personal/family medical history, with specific reference to smoking, use of steroids and cancer history.
- 2. Previous or interval work history, including hazardous waste site sampling activities, site investigations, industrial hygiene and monitoring reports.
- 3. Standard physical examination.
- 4. Audiogram performed by certified personnel. Audiogram equipment shall have been calibrated within the last 12 months to meet the most current ANSI standards and shall be biologically checked daily.
- 5. Pulmonary functions testing by trained personnel to record forced vital capacity (FVC) and forced respiratory volume in one second (FEV_1) .
- 6. 14" x 17" posterior-anterior chest X-Ray (three-year intervals).
- 7. Resting electrocardiogram (ECG).
- 8. Pap smear (for women), at intervals recommended by the American Cancer Society.
- 9. Vision profile.
- 10. Routine urinalysis, including occult blood.
- 11. Complete blood count (CBC).
- 12. SMAC-23 profile which includes calcium, phosphorous, glucose, uric acid, BUN, creatinine, albumin, SGPT, LDG, globulin, A/G ratio, alkaline phosphatase, total protein, total bilirubin, GGT, sodium, potassium, chloride, CO₂, triglycerides, cholesterol, and creatinine/BUN ratio.

Proof of medical examinations must be provided prior to start of work at the site.

5.2 PERSONNEL SAFETY

In order to provide the greatest degree of safety to on-site personnel, field personnel will be required to wear personal protective equipment. SAIC has also developed decontamination procedures that will be followed either routinely at the end of the day or for the treatment of accidental exposure to potentially hazardous chemicals. SAIC will provide guidance for protective clothing, safety procedures, etc.

Safe work procedures must be followed and personal protective equipment must be used for preventing worker exposure to toxic materials. The success of work procedures and protective equipment in protecting worker health is greatly dependent on worker cooperation.

It is understood that the more encumbered with protective equipment the worker becomes, the more difficult it is for him to perform the job expeditiously, However, the following Standard Operating Procedures in this section are a practical balance of worker protection and freedom of movement that should allow the work to be done without compromising worker health or safety.

5.2.1 Safety Equipment

On the basis of previous drilling and sampling activities at the site, Level C-D protection was selected for all drilling activities. This consists of the following personal protective equipment: The Driller is responsible for supplying these items.

- Full-face air-purifying respirator with organic vapor cartridges,
- Safety goggles (non-vented) and hard hat, or
- Hard hat and attached face shield,
- o 1-piece, chemical-resistant disposable coveralls,
- Chemical-resistant protective gloves,

- Chemical-protective boots equipped with steel shanks and toes,
- o First Aid Kit,
- o Ear Plugs,
- o Eye Wash Kit,
- o Fire Extinguisher,
- o Emergency air escape packs for each worker.

It will be the responsibility of the Subcontractor to maintain an adequate supply of expendable materials (i.e., coveralls, gloves and respirator cartridges) for Subcontractor personnel for the duration of the drilling program. Level C protection may be downgraded to a modified level D protection during the program, but only at the direction of the SAIC Supervisory Geologist. Levels A and B are presently not anticipated.

5.3 DRILLING SITE HEALTH AND SAFETY PROCEDURES

Procedures to be employed to ensure personnel health and safety are outlined in the following sections. The Supervisory Geologist will have the authority to enforce these procedures.

- Designated safety equipment will be worn at all times.
- 2. Wearing of contact lenses will be prohibited.
- 3. Eating, drinking, smoking, chewing gum, chewing tobacco, or open flames will not be permitted in the immediate vicinity of the drill sites. Gloves and chemical-resistant coveralls will be removed and hands and forearms will be washed before eating, drinking, or smoking.
- 4. A "safe" area will be designated at the site where drinking water and washing facilities will be available.
- 5. Food will be eaten only at the designated "safe" area located away from the immediate area of activity following proper decontamination.
- 6. Proper decontamination procedures will be followed before leaving the immediate area of activity.

- 7. Soil, rock and groundwater samples will not be handled without protective gloves.
- 8. Level C personal safety equipment, including respirator and goggles or face shields, as appropriate, will be worn at all times unless the level of protection deemed necessary by the SAIC Supervisory Geologist is downgraded to "D". If working at Level D, Level C safety equipment will be put on at the first sign of/or suspected sign of free hazardous material (odor or taste detected, sound of gas release, or indication by monitoring equipment).
- 9. The use and maintenance of all respirators will be in accordance with the manufacturer's instructions. Only NIOSH/OSHA-approved respirators will be used.
- 10. No one will be permitted to use a respirator without proper training and fit test certification.
- 11. Beards will not be permitted. Respirator facepieces must contact the skin directly.
- 12. Vaseline or other materials will not be permitted to provide a proper seal.

5.4 EMERGENCY PROCEDURES

A site-related emergency is defined as an accident, illness, or personal exposure to hazardous substances. The response to an emergency situation is two-fold: obtaining assistance and treating the problem.

The SAIC Supervisory Geologist will have a list of emergency telephone numbers including police, fire department, hospital, and poison control center.

In case of a health-related emergency, appropriate first aid will be applied by personnel at the site until medical assistance arrives. In the event of exposure to hazardous materials, the victim will be moved away from the contaminated area and then treated.

If a site-related emergency occurs to either a team member or another party during the site investigation, the SAIC Supervisory

Geologist is responsible for notifying the SAIC Corporate Health and Safety Officer and submitting an incident report. Another team member may submit the report if the SAIC Supervisory Geologist is unable to do so, or as delegated by the SAIC Supervisory Geologist.

The incident report will include the following:

- o Date, time, and place of occurrence
- o Person(s) involved
- o Type of incident
- o Description of incident and action taken
- Recommendations for prevention of a similar occurrence.

The SAIC Supervisory Geologist and Corporate Health and Safety Officer will discuss the incident and possible solutions for preventing a reoccurrence of the incident.

The report will be signed and dated by the person completing it. The SAIC Corporate Health and Safety Officer will sign and date the report upon receipt. All incident reports and follow-up action on the incidents will be kept on file by the SAIC Corporate Health and Safety Officer.

5.5 DECONTAMINATION

After each day's use and before leaving a site, all contaminated equipment and materials will be washed with water and detergent, as appropriate. The wash-down water will be disposed of on-site. Contaminated clothing and equipment will be bagged and kept away from "clean" material until decontaminated or disposed at the site.

ATTACHMENT II Statement of Work

BID SUMMARY

RFQ # _____

Firm	·	
	ress	
Name	(s) of Principals to Contact:	
(Cor	tractual)	
•	Name/Title Telephone Number	
(Tec	hnical)	
•	Name/Title	
	Telephone Number	-
Simi	lar Job Experience:	
1.		
	Contact	
	Telephone Number	
2.	-	
2.	Contact	
	Telephone Number	
3.	G-t-t-	
	Contact Telephone Number	
auge of 1	of Drill Rig to be committed to the rig). Attach brief resumes of operarticular interest is the number ator has working the rig proposed.	erators of the rig proposed;
1.	Riq Type	Operator

TASK I

DRILLING COST BREAKDOWN

Pricing:	& safety s in Section approximation	per foot shall included upplies, drilling and notes and decontaminately 1 hour for each equipment).	d sampling ation requ	materials irements	listed (assume			
Daily Log	Form:	The daily log form SAIC Supervisory Geach day and will The final log form withe SAIC Field Manawell is accepted. met before the SAIC (i.e., surface compared)	eologist abe the bas will serve ager must All specif C Field Ma	and the sis for bas a summ sign before ications in ager will	Driller illing. ary and ore the must be ll sign			
Drillings following	and sampl:	ing rates for Task I	which is	comprised	of the			
o 3 o 1		otage oon Samples nth of August, 1992	Protection	n Level				
1 5-2114			С	D				
	ng of soil borings includes nment (cost/foot): rd split-spoon samples	/ft	/ft					
2. Standa:		poon samples	/samp	le/s	ample			
Other Ass	ociated Co	sts:						
1. Mobi	Mobilization/Demobilization per drill rig							
Stand betwo Subco paid appro	Standby rates \$/hour. Standby time will not be paid for decontamination of equipment between wells, equipment downtime, and unavailability of Subcontractor-supplied materials. Claims for standby will be paid at the approval of the SAIC Field Manager. Final approval by the SAIC Field Manager of Subcontractor completed logs will be the basis for the payment of standby time.							
		a around the complete ortation of cuttings			ite. _/well			
4. Renta	al of stear	n cleaner and deterg	ent.	\$	_ _/day			

- 5. Drums for cuttings and development water (DOT-approved), and transport to approved, on-site storage. \$____/drum
- 6. Estimated time to complete the specified work.

 /day(s